inSCight

Inspiring stories from the Faculty of Science

ISSUE 16 | 2022

Pushing boundaries in energy and transport

Harnessing hydrogen

Decarbonising New Zealand's energy sector

Prepare for take-off

Passenger aircraft capturing climate data

Anchors aweigh?

The hidden damage from ships waiting at port

UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau
NEW ZEALAND

SCIENCE

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EDITOR
Maya Breen

WRITERS
Samuel Mannell, Maya Breen

FEATURE WRITERS
Owen Poland (OP Media Ltd),
Samuel Mannell, Maya Breen

DESIGN
Jacinda Torrance
(Verso Visual Communications)

PHOTOGRAPHY
Dean Carruthers, Billy Wong

EDITORIAL CONTACT DETAILS
inSCight
Faculty of Science Communications
and Marketing
University of Auckland
Private Bag 92019
Auckland 1142, New Zealand
science.auckland.ac.nz/about-inscight

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Cover photo: Truestock/Elton McAleer
A striking circular panorama of Auckland's luminous city skyline at night.

A word from the Dean

Kia ora tātou

WELCOME TO THE 2022 edition of *inSCight*. This edition is themed around energy and transport, which have grown in prominence as supply chain issues have featured, fuel prices have risen alarmingly, both contributing to cost of living increases, and the reduction of carbon use in both travel and energy production becomes urgent as we address the climate crisis.

We will be exploring many of the ways in which research in the faculty has responded to these issues in the past year.

Getting creative with clean energy

Associate Professor Geoff Waterhouse in Chemical Sciences is working on novel ways to generate hydrogen fuel as part of a newly awarded James Cook Fellowship. This work focuses on use of a new type of catalyst – metal single atom catalysts – for driving the oxygen evolution and oxygen reduction reactions needed for a viable hydrogen economy. This builds on prior work by Geoff on prototype metal-air batteries.

Also working in the renewable energy space is alumnus Henry Chen, currently working for TESLA Asia Pacific, but based out of Auckland, undertaking forecasting for solar generation. This is on the back of Henry winning the global Clarkson Medal for undergraduate Maths and Physics, often referred to as the Junior Nobel Prize, for his work on periodic orbits of quadrilateral billiard tables. While this fundamental work provided new insights for billiards and new connections to number theory, it unfortunately did not improve his ability to play billiards in real life!

Choosing greener travel routes

Another alumnus working on reducing travel impacts is Norman Thom award winner Cody Lim, a Master of Environmental Science graduate who supports teams at Auckland Transport to develop and deliver travel behaviour change programmes.

In this issue

Associate Professor Yun Sing Koh and Professor Gill Dobbie from Computer Science are also looking to reduce the carbon costs of travel in a micromobility research partnership with Beam, to identify and promote priority pathways to reduce transport emissions.

The power of data

Taking a different slant, Dr Mike Laverick from the Centre for e-Research is working on a large international project to receive and visualise data from sensors on Air New Zealand passenger aircraft designed to capture highly detailed environmental satellite data below the clouds over New Zealand to undertake better climate modelling.

Taryn Smith, an undergraduate student studying Geographic Information Science and Environmental Science, is looking at the next step: to integrate GIS and Environmental Science into everyday business, policy and communication and create solutions for a sustainable future.

Becoming a sustainable university

The University has been examining its own Sustainability practices through the development of a new Sustainability Strategy and associated Net-Zero Carbon Strategy. Professor Gillian Lewis, Associate Dean Sustainability, and I have been playing a lead role in the Strategy development. The strategy has ambitious goals for the University to become a net-zero carbon university by 2030, to have more societal impact from our sustainability research and teaching, and to get its decision-making structures right so making a sustainable decision is the easy decision.

Dr Charlotte Jones-Todd exemplifies the types of action necessary to assist us to reach these goals with her alternative to international conference travel, exchanging air travel for a Raglan hub approach to conference realisation.

Deputy Dean JR Rowland demonstrates our commitment to sustainability research impact through her leadership of our new University Research Centre, Ngā Ara Whetū – the first Auckland pan-university centre focusing on sustainability issues.

Rounding out the issue is a profile of Jessie Houston, a Tongan/New Zealand European BSc (Psychology) student highlighting Leadership through Learning, a leadership development programme for Māori and Pacific students, as well as an article on the new Matariki public holiday and the future plans for Tuākana.

Returning to the transport theme, Dr Sally Watson, from the Institute of Marine Science and NIWA, has been exploring the impacts of ship anchoring on the seafloor, work that has been published in *Nature*. With the supply chain issues we have been having, we have seen more ships being moored offshore, and hence more concern for the impact they have.

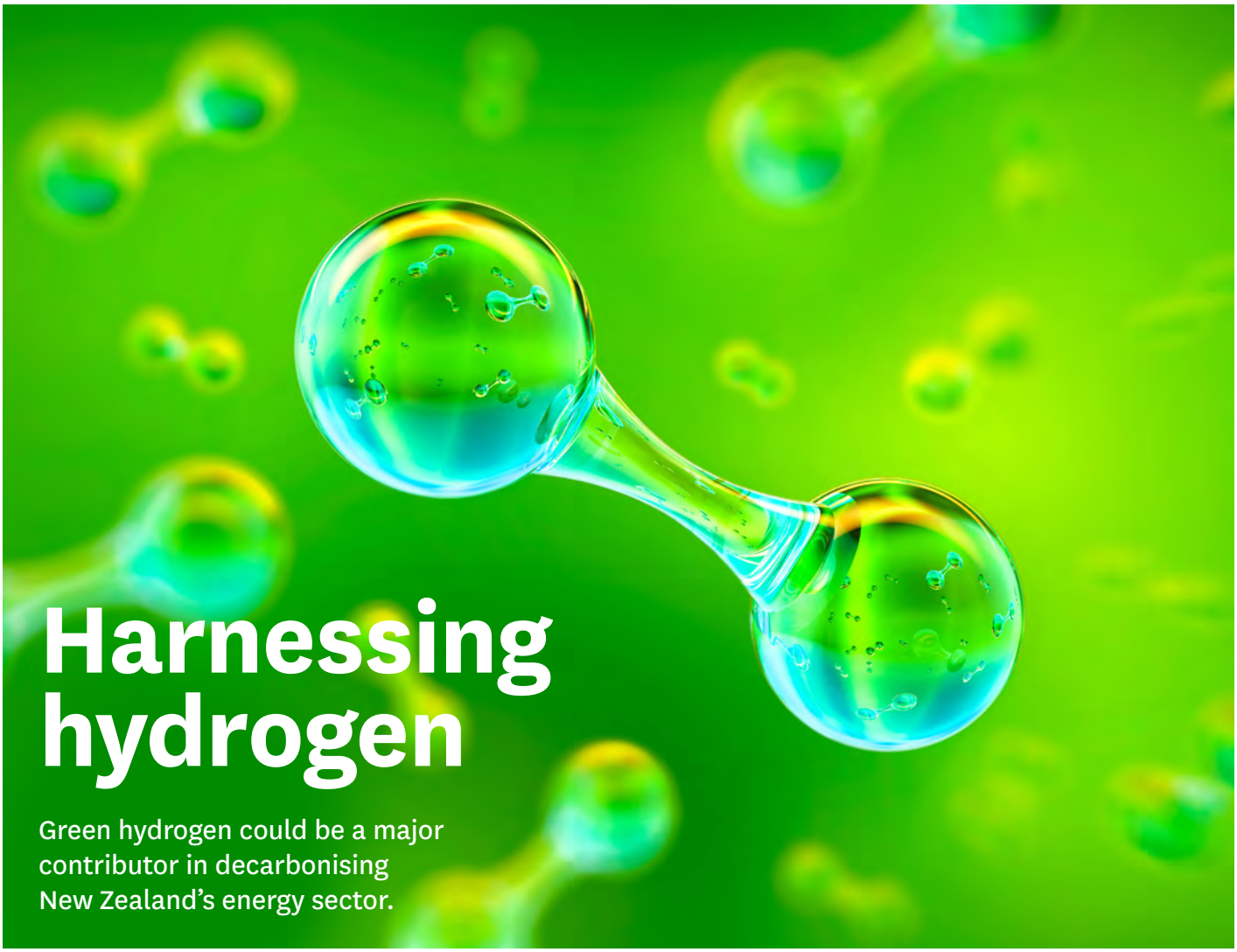
Shutterstock/Blue Planet Studio

"...the reduction of carbon use in both travel and energy production becomes urgent as we address the climate crisis."

As always, a diverse set of contributions from our diverse and impactful faculty. I do hope you enjoy it and that you and yours are surviving well in these unusual times.

Ngā mihi

PROFESSOR JOHN HOSKING
Dean of Science,
University of Auckland



Harnessing hydrogen

Green hydrogen could be a major contributor in decarbonising New Zealand's energy sector.

IF THE GOVERNMENT'S recently commissioned 'Hydrogen Roadmap' is anywhere near correct, green hydrogen could account for around eight per cent of New Zealand's total energy demand by 2050 and support decarbonisation in export markets in countries like Japan, Korea and Singapore.

Vehicles powered by hydrogen (H_2) are already being trialled and, starting in 2023, Taranaki-based Hiringa Energy plans to assemble a nationwide green hydrogen refuelling network for the heavy transport sector. There's even talk of the South Island's Manapouri hydro station being converted into the world's largest hydrogen production facility – once the Tiwai Point smelter closes.

"New Zealand's in quite an enviable position that we can make lots of electricity in a green and sustainable manner which we can then use to produce hydrogen fuel," says Chemical Sciences Associate Professor Geoff Waterhouse. "Potentially, we can completely decarbonise New Zealand's energy sector, and also have these exciting export opportunities in the Asia-Pacific region around hydrogen."

Metal single atom catalysts

However the transition to a green hydrogen economy faces numerous obstacles including the need for more efficient water electrolysis technologies to produce H_2. The fuel cells that convert hydrogen back into electricity are also quite expensive, and then there's the challenge of developing more environmentally-friendly rechargeable batteries as a short-term electricity storage solution.

In 2021, Geoff was awarded a two-year James Cook Research Fellowship to develop catalysts for the oxygen evolution reaction (OER) and the oxygen reduction reaction (ORR) that are vital chemical processes in water electrolysis, fuel cells and rechargeable metal-air batteries.

Historically, precious metal nanoparticle catalysts containing platinum, ruthenium and iridium have been used to drive these reactions. But only metal atoms on the surface of the nanoparticles participate in OER and ORR so metal atoms in the interior of the nanoparticles do very little and are effectively wasted.

The focus for Geoff is on the discovery and technology transfer of low-cost metal single atom catalysts based on earth-abundant metals like iron, nickel and cobalt. By making metal single atom catalysts, comprising isolated metal atoms immobilized on a conductive support, 100 per cent utilisation of the metals is possible. "That's where my James Cook Fellowship comes in," says Geoff. "It's about improving the utilisation efficiency of metal atoms when you're making catalysts for these devices, whilst at the same time substituting precious metals for cheaper metals."

It may sound complicated, but Geoff's work takes inspiration from nature. In designing metal single atom catalysts for the oxygen reduction reaction, he noted that haemoglobin which transports oxygen around the body has an iron (Fe_2+) active site (i.e. O_2 binds to an iron atom surrounded by nitrogen atoms inside a globular protein).

"By immobilizing iron atoms on nitrogen-doped carbon supports, we have been able to accurately recreate the same type of active site, delivering electrocatalysts with remarkable activity for the oxygen reduction reaction that outperform commercial platinum-based catalysts."

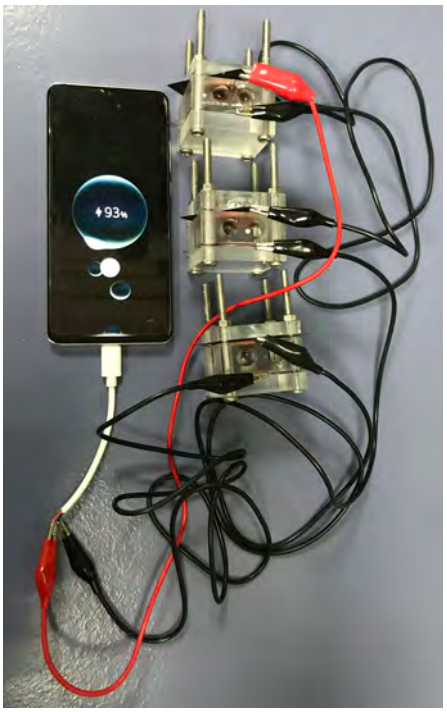
Making progress

As for timeframes, the development of metal single atom catalysts for water electrolysis is at a relatively early stage due to the fact that low-cost nickel foam catalysts are presently being trialled for this application even though they are much less energy efficient than precious metal-based catalysts.

However the development of fuel cells and rechargeable batteries containing metal single atom catalysts is far more advanced with prototype devices already built and their excellent performance validated. "We're at a really good stage where we've produced state-of-the-art single atom catalysts for ORR, comparable to anything else that's been produced in the world to date," says Geoff.

His team's previous research on the development of a zinc-air battery to replace lithium-ion batteries has been funded by electric vehicle (EV) enthusiasts Kath and Greg Trounson, and they've now committed to another two-year round of funding that will enable Geoff to bring on board three postdoctoral fellows and move things closer to commercial devices.

"This is a great example of how philanthropic donations can boost University-led research, enabling us to explore avenues that normally we wouldn't be able to pursue through the conventional funding systems in New Zealand."



A smart phone being charged by three zinc–air batteries connected in series, each using an iron single atom catalyst (Fe-N-C) for ORR during battery discharge.

Storing electricity

Efficiency in electricity storage, and efficiency in getting electricity out of batteries or H_2 are the key challenges to be addressed and Geoff sees recyclable rechargeable batteries as being important for a future hydrogen economy.

"New Zealand has great capacity to create electricity. Rechargeable batteries represent a short-term electricity storage solution, and hydrogen production represents a longer-term electricity storage solution – especially for grid-scale electricity storage – alongside technologies such as pumped hydro."

While the New Zealand Government has set ambitious goals to reach 100 per cent renewable energy by 2035 and become a carbon neutral economy by 2050, Geoff says that he's not driven by either political or commercial imperatives.

"I do see potential for this stuff to head towards commercialisation but that's not my personal driver. My personal driver is to discover really good catalysts for OER and ORR and then potentially license our catalysts out to the manufacturers of these energy-conversion devices so they can build them."

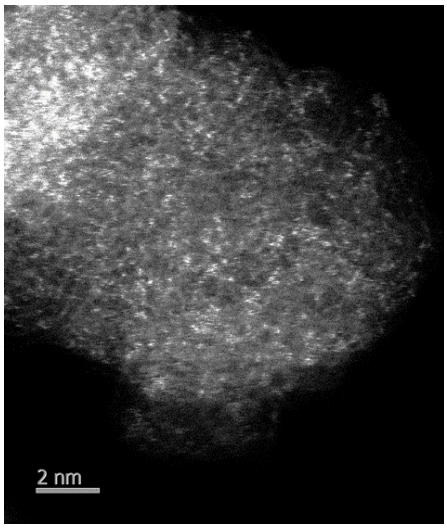
Working together

Building close relationships between countries and sharing ideas is key to global decarbonisation efforts in the energy sector, and Geoff collaborates nationally and internationally in his OER and ORR catalyst development work with researchers in the MacDiarmid Institute and leading research institutes in China. He is also part of a New Zealand team that was recently awarded $2 million to partner with German scientists in the development of anion exchange membrane electrolysers (AEMEL) which could drastically reduce hydrogen production costs.

In a novel twist, the iron single atom catalysts that his group has developed for ORR also show promise in the electrochemical extraction of uranium from seawater. "There's a thousand-fold more uranium in the earth's oceans than in ore on land. So if you can come up with a way of actually harvesting uranium from the seawater, this could support the whole decarbonisation initiative."

It may be off the agenda in New Zealand, but Geoff says that other countries see nuclear power as a clean way of producing electricity and "we should not discount nuclear power as part of a global zero-carbon future".

Associate Professor Geoff Waterhouse.



Scanning transmission electron microscopy image showing iron single atoms (bright spots) on an N-doped carbon support. The 2 nm scale bar corresponds to 1/40000 the width of a human hair.

Prepare for take-off: the Rongowai mission

The sensors on-board the Air New Zealand Q300 aircraft will record direct and reflected signals from GNSS satellites.

Imagine if domestic flights crossing the skies each day in New Zealand were not only taking people places, but reeling in vast reams of environmental science data in fascinating detail at the same time.

THE RONGOWAI mission is an international collaboration to make this endeavor a reality and achieve something never done before; to capture this data by fitting a scientific payload instrument within the hull of one of Air New Zealand's Q300 passenger aircraft.

The mission is part of NASA's Cyclone Global Navigation Satellite System (CYGNSS) mission, and along with Air New Zealand, includes the University of Auckland, the University of Michigan responsible for building the device, Ministry of Business, Innovation, and Employment (MBIE), New Zealand Space Agency, Ohio State University and University of Canterbury. The project is supported by MBIE's Catalyst Fund, the University of Auckland Vice-Chancellor's Strategic Development Fund and NASA.

The Faculty of Science's Centre for e-Research (CeR) is hosting the data centre for the mission and Dr Mike Laverick is one of the Centre's Senior Solutions Specialists, reporting to Auckland Adjunct Professor and Engineering alumna, Dr Delwyn Moller, who is leading the project. Originally from the UK, Mike has a background in astronomy and astrophysics. "I've spent a good portion of my academic life staring away from the Earth instead of towards it," he says. After completing his PhD in Belgium he moved to New Zealand in 2020 just before the borders closed and hit the ground running with the Rongowai project.

Next-gen tech to combat climate change

Rongowai is the first of the next generation Global Navigation Satellite System Reflectometry (GNSS-R) receiver and payload box that will be installed inside the aircraft. It receives two types of signals; direct signals from GNSS satellites up in space (from up to 20 satellites at the same time); and reflected signals from these satellites, rebounding off the Earth's surface. Using these reflections, many environmental measurements can be made, says Mike, including soil moisture which can help to track climate change indicators such as drought, coastline erosion and flooding.

"We can monitor inundation and flooding events, like the Christchurch flooding last year, monitor precursor conditions that indicate susceptibility to flooding, and do the same in the other extreme for drought events, all by monitoring soil moisture conditions," he explains. "Then all of the data we produce is going to be made publicly available so it can have as large and as meaningful an impact towards New Zealand and climate change as possible."

Air New Zealand is acutely aware of the role it needs to play in addressing climate change and Chief Operational Integrity and Safety Officer, Captain David Morgan, says it is the biggest crisis facing the airline. "We don't take our position lightly and we're committed to reaching our goal of net-zero carbon emissions by 2050 – Flight NZ0," he says. "We've made a number of key moves on our journey towards a greener future. But we also know it is not something that can be solved alone. It will take a collective effort from both public and private sectors to come together to make real change.

"With flight paths covering most of New Zealand, our daily operations can become a significant tool for the global science community," adds Morgan. "Our Q300 aircraft fly at around 16,000 feet – significantly closer to the earth and sea than NASA's satellites. By flying the receivers, we'll enhance NASA's satellite data with a daily feed of high resolution, high impact information, with significant potential for the science community."

Breaking new ground

As Rongowai is the first of the next generation of GNSS-R sensors, it is expanding the frontier of what the satellite receiver is technologically capable of, in image resolution, data volumes and the kinds of data it can capture.

"The successes and lessons learnt in creating and operating Rongowai are going to directly feed into and shape future GNSS-R missions," says Mike. "So on the technical front, it's achieving a lot just by existing."

Air New Zealand is set to be the first passenger airline in the world to join a NASA earth science mission, which if successful will hopefully pave the way for more scientific remote sensing instruments to be carried by commercial aircraft in the future.

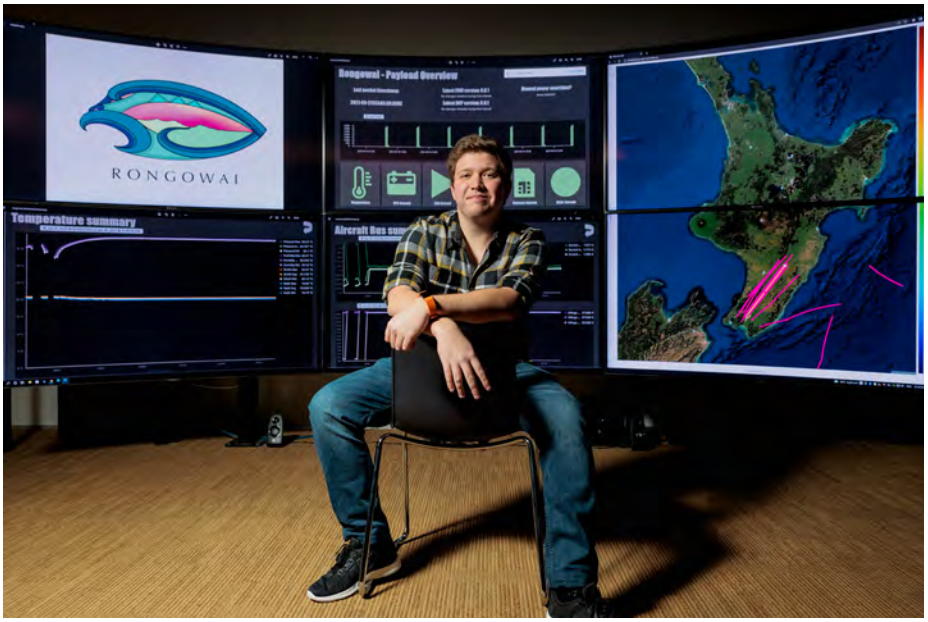
"The ultimate goal is of course the climate front, which is to make sure that the data generated from Rongowai actually has a real world impact across research and industry, to help Aotearoa make informed decisions with respect to the environment and driving meaningful change in policy and in practice."

One application Mike hopes that soil moisture data will have, is helping to monitor regenerative agricultural practices taking place in New Zealand over the coming years and to validate how these practices are making a difference to the environment.

Bringing in a mountain of data

The volume of data Rongowai can capture is on a vast scale. It is capable of simultaneously capturing 20 reflections as often as every second for the duration of the flight, with the aircraft making four to five flights each day for the next five to ten years. Air New Zealand's Q300 fleet covers flight routes to 18 locations all over New Zealand and if the launch is successful it may look to install the technology more widely across this fleet.

The CeR is responsible for transferring all the scientific and diagnostic data from Rongowai's receivers on the aircraft, to their servers at the Science Payload Operations Centre (SPOC), which was purpose built at University of Auckland, funded by MBIE. Here they can process the data into valuable science data products, host it and make the data publicly available.



Dr Mike Laverick in the Centre for eResearch Visualisation Suite. Displayed behind are the Rongowai telemetry dashboards, live flight tracker, and logo. Photo: Billy Wong

Visualising the data is another important element of the Centre for e-Research's role in the project. Mike and the Centre's team are working alongside independent science agency Toha, and data management and analytics platform, Takiwā, to determine how best to visually present the data and to ensure it has extensive public reach.

Overcoming adversity

No project is without its challenges, and Rongowai was no exception. Just as the pandemic slowed the whole world down, the domino effect from COVID-19 hampered the mission's progress, creating difficulties with shipping deliveries and laboratory access. But given the aviation industry was one of the hardest hit by the pandemic and almost brought to a halt globally, a September launch date within three years of the project commencing seems nothing short of remarkable.

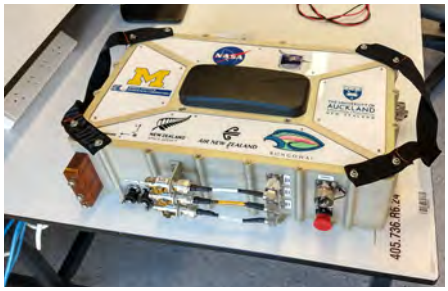
Another big challenge was co-designing and testing Rongowai to be certified for commercial aircraft use, says Mike. "Passenger safety is paramount. You can't just install any old thing on an airplane. It needs to be fully certified and fully tested before it can be used on board." This process was a collaboration between the University of Michigan, Air New Zealand's engineers and the Civil Aviation Authority (CAA).

Preparing for launch

In July the project passed a major milestone; the handover and acceptance of custody of Rongowai from the University of Michigan that built it to Air New Zealand, taking place after bench testing at the University of Auckland. Mike says this was the checkpoint that really hit home with the team, that this groundbreaking scientific equipment would soon take flight.

At the time of writing, Rongowai was scheduled to launch in September 2022. Once installed within the aircraft, it stays there and if all has gone to plan, it'll be sending a wealth of valuable climate data in substantial volumes to SPOC, for many years to come. "It's like launching a satellite into space," says Mike. "You're never going to touch it again. The only difference is you'll come within a meter of it if you're on the right flight!"

The name Rongowai was gifted to the mission by University of Auckland's Kaiarataki, Pro Vice-Chancellor Māori, Michael Steedman in consultation with Air New Zealand's Henare Johnson. To learn more about its meaning and the Rongowai logo, visit: **spoc.auckland.ac.nz/rongowai-the-name**



The Rongowai payload freshly arrived in Aotearoa, about to undergo bench testing at the University of Auckland.

Paving the way to a greener commute

Environmental Science alumnus Cody Lim enjoys knowing that his work makes a difference in people's lives.

ORIGINALLY FROM Singapore, Cody Lim's Master of Environmental Science studies have led him to be a Community Transport Team Leader at Auckland Transport.

"Being in a new country, I was curious about everything and was open to exploring and learning about Auckland and the University. I did not know anyone when I first came here, so I was motivated to network and gain work experience in any way that I could."

His interest in geography and environmental science began in high school and he pursued this interest by studying Geography during his undergraduate years.

"It started off with being fascinated by the formation and beauty of natural landscapes, but I was exposed to a wide range of topics within the field and learnt more about the impacts that humans have on the natural environment," says Cody.

"After I graduated, I dabbled in roles related to the environment such as park planning and promoting sustainable living through community engagement programmes in an attempt to play a part in the environmental sector."

But his interest to learn more about the relationships between human and physical environments resulted in undertaking his Master's studies at Auckland.

During his studies, Cody received an International Student Excellence Scholarship, a Faculty of Science Sustainability Network Research Award, and the Norman Thom Award to support his environment-related postgraduate research.

Cody Lim. Photo: Dean Carruthers

In what way did the scholarship and awards help your studies?

"Receiving the University scholarships and awards made me feel that my work was recognised and valued. It motivated me to put in even more effort to do better, knowing that I was contributing to other ongoing research and building up knowledge in the field that I was working on."

What does your work at Auckland Transport involve?

"In my role at Auckland Transport, I lead and support teams to develop and deliver travel behaviour change programmes. These programmes aim to increase sustainable commuting and instil road safety awareness through engagement and partnerships with schools, communities, and internal stakeholders."

What programmes are you working on at the moment?

"We run engagement programmes in schools that promote active modes such as walking and cycling. Some of our programmes include promoting and facilitating the setup of walking school buses, teaching cycling safety and skills to students, and classroom lessons on the environmental impact of vehicle emissions."

What has been the highlight of your career so far?

"The people. The people in my team are super passionate about what they do. They care about what they are doing, the safety and wellbeing of students, and the environment."

Where do you see your career heading?

"I am still quite new to the team and organisation, so my goal is to learn as much as I can about what we do, especially being new to the country and city too. After that, I hope to contribute to environmental sustainability at a more strategic level. In the future, I could take all that I learn here back home to Singapore if I ever move back."

What kind of impact do you hope your work will have?

"I hope that my work will help increase the awareness on environmental sustainability, encourage people to play a part in their daily lives through small ways to help combat climate change, and even inspire people to become champions for us to spread the message and facilitate these conversations and activities in their communities."

Finally, tell us something about yourself that we can't learn by Googling you!

"My fascination in natural landscapes has brought me to visit places like Greenland and Faroe Islands – these places were extremely beautiful and I absolutely loved it!"

Sustainability Research Award

The Sustainability Research Awards were set up to boost the profile of sustainability and improve sustainable practices at the University. Each year, the Faculty of Science Sustainability Network grants ten awards of up to $2,000 each to eligible science students. The awards support students with their living costs whilst they are involved in research projects related to either sustainability at the University or a broader sustainability issue. **science.auckland.ac.nz/sustainability-research-awards**

Probabilistic forecasting in the renewable energy industry

Clarkson Medal winner and Applied Mathematics and Statistics alumnus, Henry Chen, has already had many successes in his young career.

HENRY CHEN chose to study applied mathematics because of its creative yet rigorous nature. "Studying applied mathematics has sharpened my analytical skills, and my Honours year assisted immensely with my soft skills. Presenting my research at conferences transfers over nicely to communicating with clients in industry," he reflects.

"I was privileged enough to have been supported by the University of Auckland Postgraduate Honours scholarship which covered the tuition fees with a healthy stipend on top. The scholarships I have received have helped me immensely as without them, I may not have enrolled and pursued a degree at university."

Henry graduated in 2020 with a First Class Honours in Applied Mathematics and now works as a Senior Forecasting Analyst at TESLA Asia Pacific in Auckland.

In 2021, Henry was named the global winner in the Global Undergraduate Awards for Mathematics and Physics and received the Clarkson Medal, often referred to as the 'Junior Nobel Prize'. He topped more than 2400 submissions across 292 tertiary institutions to receive the accolade for his research on mathematical billiards.

How did you feel when you won the Clarkson Medal?

"I was genuinely so surprised to have won the Clarkson Medal, especially since this is only the second time a University of Auckland student has been a Global Winner (Harry She won for Computer Science in 2019).

"I feel ecstatic and honoured to have my research recognised on the world stage. I am grateful to have had such an amazing supervisor in Professor Hinke Osinga and I hope this inspires many more University of Auckland students to produce quality research and be recognised as global winners in their respective fields."

Are you enjoying your role at TESLA Asia Pacific so far?

"I'm loving it. Work is very flexible and my boss, manager and colleagues are a pleasure to be around. I get opportunities to collaborate with people from our UK and US offices as well. Now that we are on the other side of the pandemic, I hope to visit these offices in person soon."

What does your role as a Forecasting Analyst involve?

"I maintain electricity load models for New Zealand, Australia, Japan, Philippines, Singapore, and India and create custom demand forecasts for generators and retailers. I am also involved in the Trading Risk Group of the Innovation Program, where we are deploying and assessing a probabilistic forecast."

Can you tell us about a recent project you've worked on?

"I currently manage the Accuracy Metrics subgroup of the Trading Risk Innovation Team. We work with the US office to assess how the probabilistic forecasts perform with different weather vendors. Probabilistic forecasts will be important with the increased uptake in renewable energy generation.

"Cloud cover has a massive impact on the amount of electricity solar panels will generate. One minute the sky will be clear and blue so the electricity load will be low (since everyone is using their own solar energy). Clouds may come over the next minute and electricity load will skyrocket as everyone will need to use electricity from the grid. We want to provide accurate forecasts with probability percentiles to account for volatility in the electricity system."

What has been the highlight of your career up to this point?

"In 2021, we had a forecasting competition across all three offices. The challenge was to create the best forecast for the UK, where embedded solar was proving to be a challenge. My colleague, Asaad and I, created a smart blend which ended up winning the competition!"

Henry Chen. Photo: Billy Wong

Where do you see your career heading?

"I can see myself thriving in the energy industry with the onset of increasing renewable energy generation and challenges presented by climate change."

What kind of impact do you hope your work will have?

"While electricity load may sound abstract and niche, it affects every one of us. If the forecast is too low, generators will not be prepared to generate enough electricity and there will be blackouts (recall 9 August 2021). It is also important for the forecast to be reliable, as even if the forecast is high, the generators may not trust it and not generate electricity to save money. I hope that the work I do at TESLA Asia Pacific prevents blackouts from happening to any of us."

Finally, tell us something about yourself that we can't learn by Googling you!

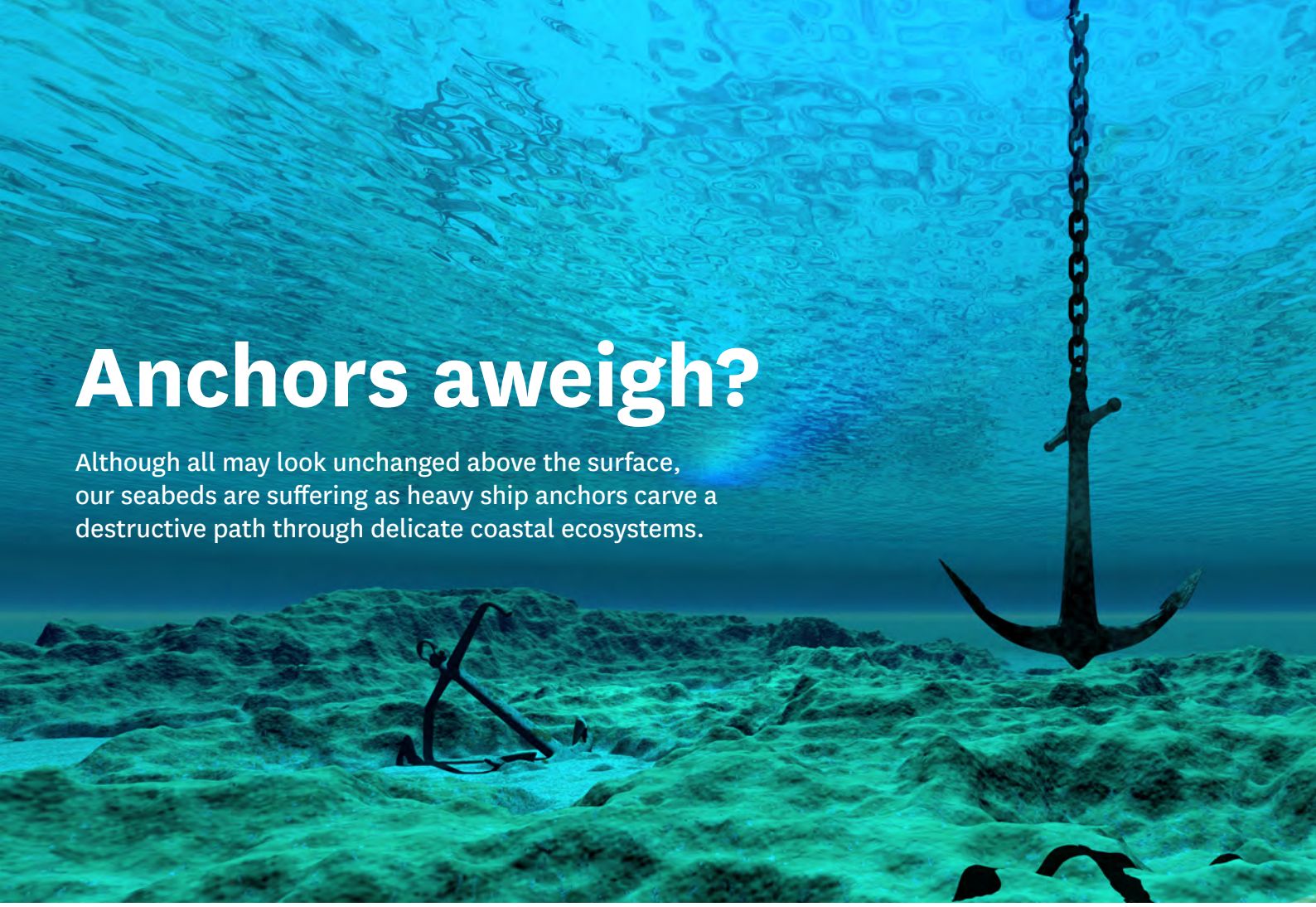
"I'm a Hufflepuff."

Science Student Support Fund

The global pandemic has challenged all of us and put added pressure on those students who may already have been grappling with financial challenges. They may need immediate emergency support due to a crisis or long-term support for those who, because of financial hardship, may not otherwise be able to undertake or complete their studies. Please help us to support our Science students by donating any amount to the Science Student Support Fund at **giving.auckland.ac.nz/science**.

Anchors aweigh?

Although all may look unchanged above the surface, our seabeds are suffering as heavy ship anchors carve a destructive path through delicate coastal ecosystems.



Shutterstock/ Veronika Surovtseva

A WORLD-FIRST study into the damaging environmental impact of ships' anchors may have never happened if it wasn't for the keen eyes of researchers including University of Auckland Marine Science lecturer, Dr Sally Watson.

In her dual role as a marine geophysicist with NIWA, Sally led a team that was poring over high resolution images from a hydrographic survey of the Queen Charlotte Sound, when they noticed distinctive gouge marks on the seabed near the port of Picton that were ultimately attributed to ship anchors. "We didn't specifically choose Picton, but it just provided this real amazing example of this human impact that we haven't really described in the scientific literature very well," says Sally.

A gigantic footprint

Shallow marine areas are often home to thriving communities of plants and animals, including sea grass that provides nesting sites for large fish, but studies of benthic or seabed trawling have revealed degraded ecosystems where changing sediment chemistry and turbidity smothers filter feeders.

Images taken of the Picton seabed four years apart suggests that gouge marks can last for years. "If you could imagine someone dragging an anchor and chain along the land repetitively and regularly over short intervals, what you would end up with is a pretty bare landscape," says Sally. "And we think that the exact same thing is happening on the seabed."

The researchers estimated that a single high-tonnage vessel could excavate the seafloor by up to 80cm and displace enough sediment to fill an Olympic-sized swimming pool. Scaled up globally, the shipping 'footprint' equates to at least 20,000 square kilometres of impacted seabed – roughly the size of Israel or Wales.

What's more, the damage has been magnified by the well-publicised Covid-related supply chain issues which forced ships to anchor for longer periods outside major ports, and the study did not account for other modes of shipping like the cruise industry. "Our global estimates, which are quite big, are still very much a likely underestimate of the global footprint," says Sally.

Countdown to net-zero carbon

Given that most of the world's major ports are outside major cities, she says the research has far-reaching implications for already stressed ecosystems, "so we're expecting that anchoring is yet another impact on top of things like urban runoff or heavy metal contamination or even reclamation".

In addition to the physical destruction, another concern for Sally is the release of carbon stored in shallow marine zones which can chemically alter the environment when sediment is overturned. "We might be doing long-term damage, and we might be doing full ecosystem damage that potentially changes the entire environment in the coastal setting by disrupting buried carbon."

Interestingly, the 2021 UN Climate Change Conference (COP26) endorsed the 'Clydebank Declaration' to support the establishment of green shipping corridors between ports. However the impact of anchoring wasn't considered and Sally believes that has to change if the global maritime industry is to meet its net-zero goal.

Bright ideas

The 'silver lining' is that the additional environmental stress created by the pandemic has provided a glimpse into the future impact, especially given that seaborne trade is projected to quadruple by 2050. "Can we control its growth and make sure that the damage zone doesn't creep wider and wider with projected increases in shipping and therefore congestion?" Sally asks.

The first to admit that she's "not an expert in maritime logistics", Sally is nevertheless brimming with ideas about

"If we degrade all of our shallow marine and coastal environments, we will suffer. This is our food basket."

DR SALLY WATSON

how to mitigate damage – from mooring blocks that confine ships to a specific area, to the revolutionary use of spikes rather than anchors to minimise the footprint.

To her, the "most compelling" option is simply to minimise the amount of anchoring with improved co-ordination of arrival times – and therefore less waiting time – something that could be achieved if ships slowed their approach to ports in the same way that aircraft do. "Obviously they get there later, but they get there on time because that's when they're needed to get there. And by reducing speed they use less fuel."

Determining who is responsible for what's being described as the 'hidden cost' of shipping is another imponderable. Is it the shipping line, the port company or perhaps a local authority? And who'll foot the bill for a solution like moorings to replace anchoring?

"I'm not surprised that people aren't interested in talking about it because it will almost certainly have an additional cost to whatever they're doing in terms of trade," says Sally. "But at the moment, the cost is being worn by ecosystems essentially."

Changing tack

With cruise ships due back in New Zealand waters later in 2022 visiting a host of picturesque and sensitive ecosystems, Sally believes that there's an opportunity to rethink how ships move around our coastline "and whether or not we can incorporate some of the findings from this paper to minimise all types of ship impacts to our seafloor".

The 2021 hydrographic (bathymetry) survey was funded primarily by the University of Auckland with support from NIWA, and Sally hopes to conduct further research on the cumulative impact of a range of human activities on the marine ecosystem – from anchoring to the amount of microplastics in sediment.

"If we degrade all of our shallow marine and coastal environments, we will suffer. This is our food basket. It's also a major economic driver," she says. "If we don't think about it until it's too late, we'll be losing a whole bunch of other things associated with it as well."

Having lived close to the sea most of her life and become a keen surfer with a "respect for the ocean", the research is close to Sally's heart in terms of understanding how the Earth works and trying to unravel stories with clues from different data sets.

"The most exciting thing about working in this space is that a lot of what we do is really frontier work and so a lot of the places that we've mapped and the things that we've seen, often we're some of the first humans in the world to see it in that particular level of detail."

To help support vital research in understanding and protecting New Zealand's marine environment, visit: giving.auckland.ac.nz/leigh-marine-fund

Sally collecting seawater samples on NIWA's blue water research vessel Tangaroa. Photo: Pascale Otis, NIWA

Above left: Sally collecting seawater samples deck using a Conductivity, Temperature, Salinity (CTD) Rosette. Photo: Dr Erica Spain, NIWA.

Top: Sally in RV Tangaroa's multibeam room where they monitor the information coming in through the echosounders to produce maps of the seafloor. Photo: Pascale Otis, NIWA

Tread lightly

Attending international conferences sustainably

Statistics lecturer Dr Charlotte Jones-Todd initiated a domestic hub in Raglan for a conference taking place in South Africa. She describes what the hybrid conference experience was like and highlights the reasons, beyond collectively reducing their carbon footprint, that drove her and her colleagues to participate as virtual attendees.

CONFERENCES ARE a key part of any academic career. Presenting to international audiences forges connections that initiate collaboration. These links support and strengthen researchers' careers. Yet, do we need to travel thousands of miles for a fifteen-minute talk and a few shared pints with our newly found international colleagues? As we all become increasingly aware of our carbon footprints, I hope not.

It's not just the carbon miles though; academia strives for equity. Yet, it remains that only those with funding can afford to travel to garner those all-important collaborations. A self-fulfilling prophecy it seems.

The pandemic quickly taught us how to move into a virtual world. Many of us attended conferences online, but in my case, I would do so only half-heartedly waiting for the 'real' conference scene to open back up again. However, the hybrid structure of a recent conference afforded a group of us from the Department of Statistics (including PhD students, research assistants and postdoctoral staff) the opportunity to foster collegiality and avoid the carbon cost to the environment. We attended the International Statistical Ecological Conference (ISEC) held in Cape Town, South Africa from Raglan, New Zealand.

Why? Attending virtual conferences over the last few years ended in me paying nothing but lip service to the talks, and continuing to work as usual. My colleagues all fell into the same pitfall and so we took a step away from the office and attended the conference remotely, but this time as a group. As well as clearly being the carbon-friendly option, people could easily join in who otherwise wouldn't have been able to attend. Conference fees were much reduced and the travel costs, by comparison, were negligible. Watching sessions as a group, after the morning coffee run, gave the much-needed step away from the day-to-day. To properly engage with conference talks this dissociation is a must.

Dr Charlotte Jones-Todd. Photo: Billy Wong

I foresee hybrid conferences becoming the norm; domestic hubs offer a carbon-friendly alternative to international travel and have many accessibility benefits. Hubs help foster collegiality and collaboration and give everyone a chance to join in. Going forward, we need to see institutions support such ventures. International conference travel is accepted as an integral part of academia; it seems remiss not to support a more accessible, carbon-friendly, and constructive alternative. In order to get a 'conference experience' from a virtual setting, we need to leave our offices!

To learn more about Sustainability in the Faculty of Science visit:
science.auckland.ac.nz/sustainability

Image: Shutterstock/Inkoly

"The hub approach was much better than sitting at home for the virtual conference! Especially because there were more impromptu opportunities to discuss conference talks."

David Chan, PhD student

"Being able to pause and talk to others between talks is beneficial. I also found it had perfectly balanced technology and tradition."

Dr Jing Liu

"I started my PhD in 2021, and have only attended online conferences as a PhD student. I really enjoyed watching the conferences with my peers and discussing the content. It was by far the best conference that I have attended, and I came away from it feeling refreshed and motivated to get really stuck into my research. The satellite conference was a great idea, and I'd love to attend many more in the future!"

Rishika Chopara, PhD student

"I liked the way the day was broken up into two watching sessions, with some live talks and others recorded, as there was scope to talk about the presentations. It also meant there was a nice balance between conference talks, social time, and time for getting other work done."

Rosemary Barraclough, Research Assistant

"I loved the way we were able to discuss the recorded talks with our research students as we went along, making it more enriching for all of us. It was also encouraging for the students to know they aren't the only ones who don't follow all the technical details!"

Professor Rachel Fewster

Taking micromobility to the next level

If people can easily view the most time efficient and least polluted route on an e-scooter, it could be a powerful tool to increase the use of sustainable transport.

RODE AN e-scooter somewhere recently? Even if you haven't, chances are you see others using them every day, especially on the city streets, with many urbanites eagerly adopting them into their daily commute.

Here in Auckland it doesn't take a scientist to deduce why. Auckland's lack of dependable public transport in many areas has long been a point of criticism. Options exist but often leave you short of your final destination, requiring you to drive or walk to a station or bus stop on either end of your trip. This gap (the 'last mile', as many in urban transport call it) is where micromobility comes in.

What is micromobility?

The term micromobility refers to the use of lightweight vehicles that typically move at speeds under 40km/hr, and that are operated by the user as opposed to say, a rickshaw, which has a separate driver. This has quickly become an exciting area for research, and the Micromobility Research Partnership (MRP©) is part of this ongoing push for a better understanding of how we can best leverage micromobility to improve our cities, funded by Beam.

The MRP© is an independent research body, comprised of researchers from a range of institutes across Aotearoa New Zealand, Australia, and globally, working with data supplied directly by Beam, one of the major e-scooter and bike rental companies with a presence here and in Asia-Pacific, where it is the biggest operator. The partnership aims to promote micromobility and sustainable transport

From left: Associate Professor Yun Sing Koh, Professor Gill Dobbie, Xuejun Shang, Ziyi Jiang. Photo: Billy Wong

research, to explore its impact on health, environment, and other UN Sustainable Development Goals.

Associate Professor Yun Sing Koh and Professor Gill Dobbie of the School of Computer Science have both been involved in the MRP© since it began earlier this year. "We wanted to ask, how do we change the way people commute?" says Yun Sing, "How do we get people out of petrol cars and into public transport?

"I want to help people understand how much air pollution they are emitting and how much they are exposed to. And we were excited to find a way to marry these together. From that starting point we decided to reach out to some companies, and one of them was Beam," she explains and Beam agreed to share their data. Thereafter the MRP© was launched to formalise academic collaborative research in Australia, New Zealand and globally, with the University of Auckland as a founding academic institution.

Safer, cleaner and cheaper transport

One of the reasons public transport is a popular topic now is the ongoing focus on inflation. As fuel prices rise, people are looking for alternatives.

"If people are using micromobility, and we can make those options healthier and safer, it's going to be better," says Gill, adding, "...when we are looking at air pollution, we are looking at traffic. As fuel prices rise, we hope people will drive less, and cut emissions. That's what Xuejun and Ziyi are working on."

Xuejun Shang, an Honours student in Computer Science, is working with the MRP© data. "We modelled air quality using air monitors around Auckland as anchor points to interpolate across a wider area," Xuejun explains. "You can see levels change over the day with rush hour."

Fellow Computer Science Honours student, Ziyi Jiang, is using the data for a related project. "I extract historical route data from the scooters to find which routes are best, based on time and pollution."

"Between the University and Britomart for example, we wanted to find the three best routes from the perspectives of time and exposure to air pollution," Gill says.

"Maybe you're willing to go a bit further," Yun Sing adds, "if the route is telling you the air is cleaner on the way."

Ultimately, it's hoped that routes like these will be served directly to users while travelling, to further encourage people to opt for micromobility and public transport, as opposed to driving short distances.

Ferdinand Balfoort, Managing Partner of the MRP©, notes the urgency in finding effective ways to address air quality and pollution issues, especially in developing countries. "According to the WHO (2021) 4.2 million people die prematurely each year from outdoor pollution. That does not factor in the long-term disabilities caused by poor air quality, nor the impact from respiratory ailments in the severity of Covid infections, as has been noted academically."

> ***"We wanted to ask, how do we change the way people commute? How do we get people out of petrol cars and into public transport?"***
>
> ASSOCIATE PROFESSOR YUN SING KOH

Hurdles and challenges

"One really big benefit of working with Beam and MRP© is having access to data," says Gill. "Often, that's the thing we struggle with the most."

"The ability to get the data and actually use it in real time is very useful," agrees Yun Sing. "It means we can test our ideas with data that's always current."

But in the context of decarbonising transport in general, how does the life cycle of an e-scooter hold up from a sustainability perspective? It's important that new technology we invest in to help us overcome modern transport challenges is resilient and sustainable.

This is another important research focus of the MRP©; it is developing mathematical models to determine the full LCA carbon footprint of e-scooters – from manufacturing to end of life – to see what emerges from Beam operational data compared to other transport modes and emissions.

In the future, this sort of research will be useful as part of the Government's commitment to reduce transport emissions. Researchers working within the MRP© have already started thinking about the possibilities of collaborating with Government agencies or local Council on their own micromobility projects and sharing their findings to improve policy, including on the development of e-hubs and Mobility as a Service (MaaS).

The next big challenge is getting good air pollution data. Both Yun Sing and Gill agree that more air quality sensors out and about in Auckland would be a big improvement, and Gill notes that "if Beam started to mount air-quality sensors [directly on the scooters], that would be great".

Riding into the future

Looking ahead at the project's future, it's easy to see how leveraging this data could encourage more people to use micromobility. "There's lots to do still," says Yun Sing, "but the ability to optimise the routes is actually quite exciting itself. We can build more complicated projects on top of that foundation... [for instance] the Turing Institute has been working on routes in London, exploring options for serving users the most beautiful route."

There are also papers reporting on similar projects in cities like Beijing and San Francisco. Beijing in particular stands to benefit from suggestions for low-pollution routes, as air-quality is a more prominent hazard there.

"We'd like to start finding the safest routes too," says Gill. "And beyond micromobility, we'd like to look into including walking but that's a bit more difficult to collect data for, of course."

With so many different researchers from various institutes working together, the MRP© is an exciting frontier for learning more about how we can improve urban liveability, and a great example of utilising real-world data. "It's been good to work on an applied project," Xuejun notes. "It's incredible to build something where we can look directly at the results out in the real world."

Gibbons Memorial Lecture Series

The School of Computer Science hosts the Gibbons Memorial Lecture Series each year, delving into different areas of computer science research. It began in 2008 and was named in memory of Associate Professor Peter Gibbons. To support the Peter Gibbons Lectures Fund, visit: **giving.auckland.ac.nz/peter-gibbons-fund**

Celebrating Matariki and the success of Tuākana

Matariki is an important time for us to orient ourselves on our journeys, and this year was the first time it was celebrated as a public holiday in Aotearoa New Zealand.

THIS YEAR marked the first Matariki celebrated as a public holiday in Aotearoa New Zealand. It can't be overstated how important this is for so many people, not only because it is bringing the traditions of Matariki to many new people, but also because it highlights an important part of Māori culture in Aotearoa.

To celebrate Matariki and the opportunity it provides us for reflection, a Kai and Kōrero was held for the Faculty of Science on Tuesday 5 July. It was also a chance for many of the Tuākana coordinators from each school and department to safely meet face to face for the first time in months, or even longer, given the pandemic.

During these difficult times the fostering of community is more important than ever, and even though technology allows us to stay connected when we are scattered, there will never be a better way of bringing people together than sharing a meal.

Of course, this occasion was about more than kai (though we were glad to have it!), it was also about manaakitanga. This is a word often translated as 'hospitality', but there is a deeper meaning behind it. Manaakitanga can be understood by breaking down each part; 'mana' is well known to many as a word that reflects the power or presence, of a person, place, or object. 'Aki' means to encourage, so manaakitanga can be thought of as coming together in a way that encourages reciprocal growth. We are all here to help grow the mana of each other. We invite others into our homes to share with us, and they in turn respect us and our homes, and this balance of respect and care in a relationship between individuals or groups is manaakitanga. Matariki is the perfect time for all of us to think about our relationships and reaffirm the respect we have for each other, especially for those coordinating Tuākana, since each school and department can be so busy that there is not often time to meet.

It was great to be able to celebrate Matariki and see so many friendly faces at our Kōrero!

Shutterstock/ Monika Wisniewska

Whakapapa of Tuākana

Among the guests in attendance were the Dean of Science, Professor John Hosking, and Kaiarataki Michael Steedman, who was the original programme coordinator for Tuākana when it first began to take shape, and who went on to become the first Kaiārahi in the University of Auckland. To open the hui John emphasised the faculty's commitment to Tuākana and thanked everyone involved for their mahi. Michael then shared with us the whakapapa of Tuākana, speaking on its creation back in the late nineties by Professor Michael Walker, who saw a need for a programme that gave students more space to grow.

Whakapapa is about both tracing the lineage of the past and understanding where you come from, and also orienting yourself in the present and understanding who you are now. For instance, not everyone in attendance knew that the Tuākana programme actually started in the Faculty of Science, before it was adopted throughout the whole University. A great example of how understanding where you come from informs your understanding of who you are now.

To that end, Michael spoke on many aspects of Tuākana, including the visual designs used, explaining that they embody excellence – an idea at the core of Tuākana. The fantastic students in Tuākana already have the skills and knowledge to contribute incredible advancements to their field of study, and the programme gives them space to explore the potential they already have.

Representatives of the Nesian Indigenous Science Student Association (NISSA) also attended the Matariki hui, as the first Pacific and Indigenous Science association at the University. NISSA's executive team contains student representatives from each Tuākana department within the faculty; NISSA would not exist as it does today without the Tuākana Programme.

Co-presidents Mena Vaimasenuu Welford, Indigo Michael, and Milly Grant-Mackie said of the hui: "Matariki for us is a time to remember and honour those staff and students who have come before us, who have helped lay the foundation for continued success and pave the way for future Māori and Pasifika scientists at the University of Auckland.

"Our vision as an association is to champion our Māori and Pasifika scientists, to tautoko their excellence and provide space for them to thrive, particularly culturally and socially. Having met our incredible whānau within the Tuākana space, and seen them investing so much love, energy, and time into their work, gives NISSA an empowering sense of hope, encouragement, and motivation to persevere in our own mahi, backed by a whānau of true legends."

Strength in difficult times

We also had a chance to talk about manawaroa – wellbeing and resilience – a concept that's especially topical right now as we make our way through the third year of the COVID-19 pandemic.

Matariki is a time for reflection on the past, present, and future, and part of that is remembrance of those who have passed on. Many of us have likely experienced loss over the past few years, and we have also lost rangitira, such as Pāpā Joe Hawke of Ngāti Whātua. When we experience loss, the reaction can be to isolate ourselves, but meeting together and supporting each other is the best way forward.

Just as Matariki is a time to remember those who are gone, it's also a time to celebrate those who are still here, and to celebrate the work that our Tuākana coordinators have done over the lockdowns we have been through. The mahi that went into creating a hybrid community and checking in on students while they were forced to study remotely is truly remarkable, and it was great to have a chance to recognise and celebrate those who put in the time and effort.

Piki atu ki te rangi

Matariki is also about the future, and the Kōrero was an opportunity to discuss piki atu ki te rangi – seeking excellence in what we do.

Speaking on the possibilities that lie ahead, Te Whare Pūtaiao | Faculty of Science Kaiārahi, Teariki Tuiono, said the programme is excited to explore, "leveraging data to better understand our communities, finding ways to structure our programmes to better serve our students, and helping students and staff alike navigate any anxieties around returning to campus.

"We are looking forward to engaging more with students with success in mind, and letting more people know about what Tuākana is all about."

Until next Matariki, ka kite anō!

The University's Māori and Pacific Scholarships Fund helps Māori and Pacific students to realise their academic dreams. If you would like to support our students in their studies, visit giving.auckland.ac.nz/maoripacificscholarships.

Te Rautaki Aronga Toitū

The University's Sustainability Strategy: its development and its future impact

"**WE WILL BE** internationally recognised for our unique contribution to fair, ethical and sustainable societies." This is the Vision statement of the University Strategic Plan, Taumata Teitei. To achieve this vision the University has been developing a new Sustainability Strategy, Te Rautaki Aronga Toitū, which we have had the privilege to work on, as co-sponsor (John) and Academic Lead (Gillian).

By way of background, the University has deep sustainability roots, including being one of only two Universities globally to have been in the top 10 of the Times Higher Impact Ranking for sustainability since the ranking was instigated (the other being Manchester University). This speaks to the deep level of sustainability research across the broad reach of the United Nations Sustainable Development Goals (SDGs), the many courses teaching material relevant to sustainability, as well as the long standing work on making our estate services more environmentally sustainable. However, much of this work has been in isolation and not well coordinated.

The Sustainability Strategy

The new strategy therefore sets goals for the University, while also aiming to provide the institutional infrastructure to achieve them. It responds to our various communities' desire for sustainability action and the urgency of the climate crisis. It has the overall goal of making us a Sustainable University by 2030. To achieve that it comprises three pou | pillars (see Figure 1).

Commitment, Contribution and Responsibility

The first pou is one of Commitment – to embed sustainability within the University's fabric, by establishing governance structures to better prioritise and coordinate our sustainability activity, and integrate sustainability deeply into our decision making processes. This allows staff to make the sustainable choice the easy choice. It also promises to measure our progress and be transparent about that to our communities.

The second pou is one of Contribution to sustainability knowledge, an area we achieve reasonably well in already. This includes educating all students in sustainability principles, to continue excelling in our sustainability research and to lead in applying Mātauranga Māori approaches to sustainability. But also to have more impact with the teaching and research we undertake by partnering well and contributing to societal needs (including the existential needs of our Pacific neighbours), as experts, practitioners, and critics and conscience of society. It also commits our campuses to be living labs, where teaching and research can be undertaken using the campus as the object of study.

The third pou is one of Responsibility; to live and act sustainably as an institution. This will be the most challenging as it must compete with our other aspirations, such as being globally excellent. This pou commits the University to being a net-zero carbon university, for its members to be climate conscious travellers and commuters, for the campus to run sustainable

Te Rautaki Aronga Toitū STRATEGY AT A GLANCE
Priorities for Transitioning to a *Sustainable University* by 2030

Our Commitment to embedding sustainability

We will:
1. Establish an effective governance structure to prioritise and integrate sustainability into all agendas
2. Integrate sustainability principles into the University's decision-making and management to make sustainable action intuitive
3. Empower staff and students to take action to achieve our sustainability aspiration
4. Measure and track our sustainability progress
5. Communicate our progress towards a sustainable university in a transparent, coherent and effective way

Our Contribution to sustainability knowledge

We will:
1. Increase sustainability literacy across the curriculum
2. Undertake sustainability-directed research and innovation
3. Lead in applying Mātauranga Māori approaches to sustainability
4. Extend our local, Pacific, and global partnerships to lead and leverage sustainability knowledge, practice and application
5. Extend opportunities for teaching, research, and operations to intersect through campus-based Living Laboratories
6. As critics and conscience of society, actively engage with and contribute to sustainability debate and policy
7. Engage our diverse communities to share in our sustainability aspiration

Our Responsibility to work sustainably

We will:
1. Be a net-zero carbon University
2. Be 'climate conscious' travellers and commuters
3. Deliver sustainable university facilities and services, including energy and water conservation and waste prevention
4. Fully engage digital capability to enhance our sustainability efforts
5. Value biodiversity, making it a priority to our estate, and reduce the biodiversity impact of research, teaching and operations
6. Operate under financial systems that facilitate sustainability outcomes
7. Embed sustainable procurement practices into all aspects of University services and processes
8. Pursue investments that demonstrate responsible practices with respect to social, cultural and environmental outcomes

Figure 1: The University of Auckland's Sustainability Strategy on a page

"We have both found working on this strategy to be one of the more challenging but also most satisfying things we have achieved in our careers at the University of Auckland."

Professor John Hosking.

Professor Gillian Lewis.

services that embrace digital means to offset the tyranny of distance, where the estate embraces biodiversity, and where our purchasing, financial operations, and investments, also embrace sustainability.

The actions in these pou will occur within the framework of Te Ao Māori which underpins Waipapa Taumata Rau/University of Auckland. The potential for this strategy to engage and empower all members of our community owes much to the influence of PVC Māori Te Kawehau Hoskins, PVC Pacific Jemaima Tiatia and the Māori Pacific Caucus.

From concept to reality

As we write, the strategy is in the midst of consultation, but will hopefully be ratified and adopted as this publication is produced. It is accompanied by a Net-Zero Carbon Strategy which fleshes out our commitments, setting targets of 50 per cent reductions each in waste, fossil fuel energy use, and, notably, work-related travel by 2030 (with additional offsets and insets to reach net-zero at that way point).

Implementation will clearly have some challenges. Travel is the most obvious one. Our 2019 emissions baseline showed that 80 per cent of our Green House Gas emissions (GHGs) resulted from international travel. We recognise that to be an internationally well connected and well regarded university demands travel to meet collaborators, present results and, of course, keep a connection with our alumni.

However, we need to be much more purposeful in that travel, combining multiple objectives into single trips, for example, using digital methods where they are suitable (see pages 12-13), and using offsets and insets where travel is justified. The data analysis we have done suggests we can reduce very significant amounts of travel without impacting our internationalisation aims. Culture change at individual and collective levels will clearly be needed to achieve this. Our estate also needs to overperform in sustainability performance, for example, by becoming a net generator of renewable electricity to provide some of the insets we need.

Making progress

In education, work in the teaching and learning portfolio has already committed every student to understand sustainability principles as one of the graduate attributes in the new Graduate Profile. This will demand every programme we teach to embed this knowledge into their teaching so tomorrow's leaders will be comfortable in making sustainable decisions.

In research, the University has already committed to the establishment of Ngā Ara Whetū, the University Sustainability Research Centre, led by our Deputy Dean, JR Rowland (see article on page 22), which will act to integrate our sustainability research, and also provide a much needed shop front for it, and the Public Policy Impact Institute, which will provide a role in taking sustainability research into public policy.

We have both found working on this strategy to be one of the more challenging but also most satisfying things we have achieved in our careers at the University of Auckland. We look forward to its adoption and its implementation – this university has much to offer to its communities and we will be delighted to see that that is achieved sustainably.

PROFESSOR JOHN HOSKING
Dean of Science

PROFESSOR GILLIAN LEWIS
Associate Dean Sustainability

To find out more, visit: **auckland.ac.nz/commitments-to-sustainability**

Leading and learning

Psychology third-year student, Jessie Houston, aspires to a career in healthcare, to combine her interests in psychology with helping people.

BACHELOR OF science student Jessie Houston chose to major in Psychology as science has always been her passion and the subject she enjoyed most in secondary school.

"Choosing my major was hard but I have always had an interest in psychology and wanted this to be the main focus of my degree," says Jessie. "I am thoroughly enjoying my third year of studying psychology. I've found these third year papers more specific with what they look into and this allows me to choose aspects of psychology I am passionate about to study."

Jessie has thoroughly enjoyed her assignments and projects so far. "In PSYCH 108 we were required to write an essay about an activity or environment that allows us to flourish as an individual. I really enjoyed this assignment and put a lot of time and effort into it, so I received a high grade for it. I also love the selection of PSYCH papers you are able to choose from in stage 2 and 3 of the course."

Being of Tongan and NZ European descent, Jessie had the opportunity in her second year to be part of the Leadership Through Learning programme for Māori and Pacific students. The 12-week leadership and development programme spans across all levels of studies, faculties and disciplines in the University and is delivered by Māori and Pacific student leaders.

"The programme allowed me to meet some amazing people, as well as teaching me many leadership skills. It also taught me about the cultures that make up the indigenous community at the University, which I now feel part of," says Jessie.

"The amazing coordinators and tutors in this programme become your whānau at the University, creating a space that brings a sense of belonging and aroha. I would highly recommend it to anyone who has the opportunity to be a part of it."

This year, the best part of Jessie's studies has been returning back to campus as the pandemic restrictions loosened, enabling her to meet new people in lab classes and lectures. She is also an active member of the Auckland University Psychology Students Association (AUPSA). "The team is amazing and it's an amazing opportunity to be able to organise events for other students as well."

Jessie Houston. Photo: Billy Wong

She adds how important it is to meet new people, especially in your first year at uni. "You will make some awesome friends that you will be able to take courses with throughout your degree."

Thinking about her career direction, Jessie is interested in the health side of psychology, considering programme pathways to qualify as a clinical psychologist or a psychiatrist.

"I am interested in pursuing a career in the healthcare system, because I have a drive to help people for my job. I have always been an empathetic and caring person and I think that a job in health is a good way to apply these traits, as well as incorporating psychology into this too," she says.

"I found that I loved to learn about why people do the things they do and how we can use this knowledge to understand people's everyday behaviours."

"I found that I loved to learn about why people do the things they do and how we can use this knowledge to understand people's everyday behaviours."

JESSIE HOUSTON

Using technology to protect our planet

Taryn Smith has found studying GIS and Environmental Science to be a perfect blend of discovering the natural world and how to safeguard it.

THROUGH HER studies, Taryn Smith says she has been able to explore and understand the world's complex natural and social processes, problems the world is facing and importantly how people can be the solution.

"I've always had a passion for the environment; growing up with hobbies that constantly had me in the outdoors made me want to learn about and explore the physical world around me," says Taryn. "The more I progressed in my high-school studies, I found that I also had a passion for technology, problem solving and understanding the role that humans play within the environment, particularly sustainability."

Her undergraduate double major choice of Geographic Information Science and Environmental Science has enabled her to combine all these ideas together.

"The evolution of technology we have access to in today's world has continued to fascinate me. Pursuing the GIS major allowed me to see the world in a different way and provided a new level of comprehension around the world's spatial patterns, relationships, trends and changes," she explains.

"In my studies, I have been able to understand the various ways we can analyse and manipulate spatial information across a broad range of topics, and to also provide a backbone for decision making and innovative future proof solutions.

"Learning the theoretical and practical skills behind the ways we can integrate GIS and Environmental Science into everyday business, policy and communication both locally in New Zealand and globally, has provided me with a stepping-stone towards a career that can make a difference."

Taryn enjoys the various modes of learning in her studies and focus on practical skills rather than solely traditional assignment styles.

"Even if you have many passions, you'll be able to gain new insights and ways of showcasing them through learning and understanding GIS, as there are so many opportunities to use creativity and merge your own ideas and interests into practical assignments."

Although the majority of her studies were taught online as a result of the pandemic, she was always able to connect virtually with her fellow students, lecturers, and tutors.

Taryn Smith. Photo: Dean Carruthers

"We were always able to get in contact and ask questions, receiving a bunch of support. What I have appreciated most is the dedication of the educators (both tutors and lecturers) to better our learning and helping us to achieve the best we each can."

She also found the Career Development and Employability Services (CDES) at the University to be very supportive, providing information on useful events and career planning sessions including interview practice.

"They have helped me to find opportunities and companies I might be interested to work for in the future, tips to prepare for meeting employers and general advice that everyone should have moving through their studies."

Outside of her studies, Taryn says the Science faculty's extracurricular activities were a great way to make friends and explore interests, whether it be a hackathon, quiz night or clubs and career events.

"I found that GIS is still a relatively niche field, and all of the students in the programme are friendly, helpful and engaged with learning and activities – which only makes it easier for you to get involved."

Emma Waterhouse Fund

If you would like to support women studying the Natural Sciences you can make a donation to the Emma Waterhouse Fund at giving.auckland.ac.nz/emma-waterhouse-fund.

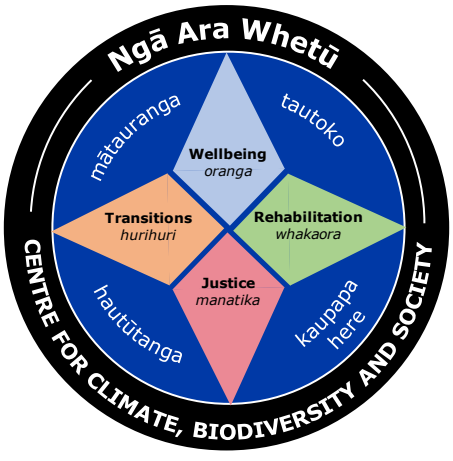
Introducing Ngā Ara Whetū: Centre for Climate, Biodiversity and Society

The University has committed substantial funding towards establishing a flagship cross-faculty research centre to respond to the pressing environmental and humanitarian challenges of our time.

EXCEPTIONAL ACTIONS are underway internationally to address the unfolding climate catastrophe that die-hard deniers must be struggling to ignore. In August, the US Senate passed a sweeping economic package that includes major legislation on climate change with the aim of cutting their country's carbon emissions by 40 per cent by 2030.

In a landmark and far-reaching move in late July, the United Nations General Assembly recognised that a clean, healthy and sustainable environment is a universal human right: it is essential for our survival. As articulated in the UN brief: member states, including Aotearoa New Zealand, "face a stark choice: to respect and uphold this right by taking action to address today's multiple planetary crises, or to delay and obfuscate".

The urgency of this call to action couldn't be clearer but change is challenging. We are in a time of increasing social fragility. Rising inequality and long-lived injustices, exacerbated by pandemics, inflationary pressures, upheavals in social norms, changing climate, and environmental degradation, create fertile ground for conflict. If we are to meet the UN's challenge, we cannot leave anyone behind.



Ngā Ara Whetū mission. The points of the star guide the work of the centre, and the intervening words articulate our operational priorities: Mātauranga – valuing wisdom and contributing knowledge; Tautoko – supporting and fostering our people, advocacy underpinned by excellent research; Kaupapa here – translating research into policy for impact and transformation; and hautūtanga – empowering leaders for action and outcomes.

Waipapa Taumata Rau University of Auckland is committed to supporting Aotearoa New Zealand to act. Over the last 12 months, researchers with expertise in law, the social, natural and health sciences, engineering, and economics, have worked together to build a new flagship University research centre – Ngā Ara Whetū: Centre for Climate, Biodiversity and Society. Hosted by the Faculty of Science and co-hosted by the Faculties of Arts, Engineering, and the Business School, Ngā Ara Whetū provides an enabling mechanism to connect the University's research strength with knowledge and wisdom of ngā iwi Māori, interested parties, and collaborators to reduce climate risk, enhance resilient and biodiverse spaces, and create fairer and healthier societies.

Working beyond traditional University borders for local and global impact, the Centre recognises that its three pou – climate, biodiversity and society – are inseparable from each other and must be treated together. Professor Jacqueline Beggs (Ngāti Awa), Director (Research) for Ngā Ara Whetū, said, "Aotearoa needs to think more holistically about our options. Solutions such as biofuels may seem appealing, but the impact on forest clearance and biodiversity in developing nations has been devastating."

"Working beyond traditional University borders for local and global impact, the Centre recognises that its three pou – climate, biodiversity and society – are inseparable from each other and must be treated together."

Professor Niki Harré, an expert in sustainability in the School of Psychology and Director (Training) for Ngā Ara Whetū, said, "A key focus for this Centre will be looking for social solutions – how to work with communities to implement positive change. We will provide opportunities for our students and new researchers to be part of transdisciplinary teams that tackle problems together."

David Noone, Buckley Glavish Professor of Climate Science in the Department of Physics, and Director (Partnerships and Engagement) for Ngā Ara Whetū, said the new Centre leverages disciplinary depth and connects across boundaries to meet urgent societal challenges: "We need transdisciplinary research centres like this one to put core science knowledge and understanding into practical nature-based, cleantech and social solutions that support society to respond to climate and environmental change."

The University has committed $1.25m in funding over five years to establish Ngā Ara Whetū: Centre for Climate, Biodiversity and Society.

ASSOCIATE PROFESSOR JR ROWLAND
Deputy Dean of Science,
University of Auckland

Connect with our researchers on Twitter...

School of Biological Sciences

@JacquelineBeggs – Professor Jacqueline Beggs

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@LoraxCate – Associate Professor Cate Macinnis-Ng

@mc_stanley1 – Associate Professor Margaret Stanley

@HilarySheppard9 – Dr Hilary Sheppard

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Department of Exercise Sciences

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Institute of Marine Science

@shellfishrestnz – Dr Jen Hillman

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Department of Mathematics

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@MathmoClaire – Associate Professor Claire Postlethwaite

Department of Physics

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UNIVERSITY OF AUCKLAND
Waipapa Taumata Rau
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SCIENCE

2023 Alumni and Friends events

University of Auckland events are always stimulating and entertaining, as well as a chance to catch up with friends and network with new people. There are mainstay events such as the Distinguished Alumni Award celebrations and the Golden Graduates lunch, plus Alumni and Friends receptions in various centres and smaller, informal gatherings led by alumni. In these unusual times we are finding many ways to connect and engage online as well.

Update your email address and we'll make sure you stay informed of upcoming events and opportunities. **alumni.auckland.ac.nz/update**

If you update before **31 December 2022**, you'll go in the draw to win one of five BLUNT Classic umbrellas.

Network with other graduates on Alumni Connect, our online informal alumni networking and mentoring tool. Sign up today: **auckland.ac.nz/en/alumni/get-involved/alumni-connect.html**

Watch our 2022 Raising the Bar talks and view/listen to other alumni content at **alumni.auckland.ac.nz/recordings**

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